

IV.G.6 Fuel Cell Operated Smart Home (New Project)*

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**Congressionally directed project*

Objectives

- To demonstrate that a 5-kW fuel cell power plant (FCPP) can satisfy the power demands of a typical all-electric home.
- To demonstrate that a 50-kW FCPP can satisfy the power demands of ten all-electric homes, connected in a micro-grid configuration.

Technical Barriers

This project addresses the following technical barriers from the Education section of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan:

- A. Lack of Awareness
- B. Lack of Demonstrations or Examples of Real World Use

Approach

In Phase I, a 1500 sq. ft. laboratory has been constructed in the existing Laboratory Building of the College of Engineering at the University of South Alabama. Inside the laboratory, a 500 sq. ft. test home consisting of two rooms has been constructed. One room is fitted with appliances normally found in the kitchen area of a home, while the other room has an entertainment system, a computer, a plasma display, and other related appliances. Electric power is supplied by a natural gas-based FCPP located outside the Laboratory Building, which is connected in parallel with the local grid. A smart sensor suite monitors all signals and activities in the house. All appliances and outlets are under the control of a Smart Energy Management and Control (SEMaC) system, which has been successfully tested to meet the above objectives.

In Phase II, a single-simulated 50-kW FCPP is being used to supply ten homes in a micro-grid configuration. Each home is equipped with a Local Energy Management System (LEMSYS). A Micro-grid Energy Management System (MEMSYS) is being developed to coordinate the individual LEMSYS systems.

The following tasks are currently under investigation:

- Economics and reliability of the micro-grid
- Thermal energy recovery strategy
- Hydrogen cogeneration
- Evaluation of alternative energy sources and supercapacitor storage devices
- Peak load reduction strategies

